AMENDMENT UNDER 37 C.F.R. § 1.116
EXPEDITED PROCEDURE
GROUP 2616
PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Docket No: Q64029

Massimo BRIOSCHI, et al.

Appln. No.: 09/833,666

Group Art Unit: 2616

Confirmation No.: 1733

Examiner: Richard CHANG

Filed: April 13, 2001

For: METHOD AND APPARATUS FOR AUTOMATIC DELAY COMPENSATION IN SPACE DIVERSITY RADIO TRANSMISSIONS

AMENDMENT UNDER 37 C.F.R. § 1.116

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Commissioner for Patents
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Sir:

In response to the Office action dated November 1, 2006, and further to the Request For Reconsideration filed this same date, please amend the above-identified application as follows on the accompanying pages.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method of compensating for a possible delay between two or more radio transmission paths in space diversity radio transmissions, said method comprises:

receiving a first analog signal;

receiving at least one second analog signal;

sampling said first analog signal and said at least one second analog signal to obtain a first digital signal and at least one second digital signal, respectively, a possible delay being present between the first digital signal and the at least one second digital signal; and

sending said digital signals to respective equalizers;

delaying, in a digital manner, ~~either~~one of said first and second digital ~~signal or said at least one second digital signal~~signals relative to the other by a period equal to an integer multiple of the sampling period, said delaying comprising automatically calculating a value of said integer multiple, and optionally

recovering, at equalization, the difference between the imposed delay and the real delay.

2. (Previously Presented) A method according to claim 1, wherein delaying comprises calculating the value of the integer multiple, wherein calculating the integer multiple comprises:

realizing delayed replicas $r_{1j}(kT_{sa}) = s_1(kT_{sa} - jT_{sa})$ and $r_{2i}(kT_{sa}) = s_2(kT_{sa} - iT_{sa})$ of said first and said at least second digital signals, with $0 \le j \le N_1$ and $0 \le i \le N_2$, $N_1 T_{sa}$ being the maximum assumable delay of the first signal with respect to the at least one second signal and $N_2 T_{sa}$ being the maximum assumable delay of the at least one second signal with respect to the first signal;

calculating cross-correlations

$$xc_{1j} = E\left\{\sum_m \sum_n a_n a_m * g_2 * (kT_{sa} - mT) g_1(kT_{sa} - nT - \tau - jT_{sa})\right\} \text{ with } 0 \le j \le N_1,$$

$$xc_{2i} = E\left\{\sum_m \sum_n a_m a_n * g_1^* (kT_{sa} - nT - \tau) g_2(kT_{sa} - mT - iT_{sa})\right\} \text{ with } 0 \le i \le N_2,$$

between the various delayed replicated signals, where * denotes the complex conjugate operation and $E\{\cdot\}$ the time average operation; and

deriving the maximum value of said cross-correlations as i and j vary, namely $M = \max_{i,j}\left(|xc_{1j}|^p, |xc_{2i}|^p\right)$ said maximum value corresponding to the value of the integer multiple.

3. (Previously Presented) A method according to claim 2, wherein the method further comprises selecting the delayed replica to be sent to said equalizers as a function of the information related to the maximum of the calculated cross-correlations.

4. (Currently Amended) An apparatus for compensating a delay between two or more radio transmission lines in space diversity radio transmissions, said apparatus comprising:

means for receiving a first analog signal;

means for receiving at least one second analog signal;

means for sampling the first analog signal and the at least one second analog signal to obtain a first digital signal and at least one second digital signal, respectively, a delay being possibly present between the first digital signal and the at least one second digital signal; and

equalizers receiving said digital signals at their respective inputs;

means for delaying, in a digital manner, ~~either~~one of said first and second digital ~~signal or said at least one second digital signal~~signals relative to the other by a period equal to an integer multiple of the sampling period, said delaying comprising automatically calculating a value of said integer multiple, and

equalizer means capable of restoring the difference between an imposed delay and the real delay.

5. (Previously Presented) An apparatus according to claim 4, wherein said delay means comprise means for calculating the value of the integer multiple, wherein said calculation means comprise:

means for realizing delayed replicas $r_{1j}(kT_{sa}) = s_1(kT_{sa} - jT_{sa})$ and $r_{2i}(kT_{sa}) = s_2(kT_{sa} - iT_{sa})$ of said first and said at least one second digital signals, with $0 \le j \le N_1$ and $0 \le i \le N_2$, $N_1 T_{sa}$ being the maximum assumable delay of the first signal with respect to the at least one second signal and $N_2 T_{sa}$ being the maximum assumable delay of the at least one second signal with respect to the first signal;

means for calculating cross-correlations

$$xc_{1j} = E\left\{\sum_m \sum_n a_n a_m * g_2 * (kT_{sa} - mT) g_1 (kT_{sa} - nT - \tau - jT_{sa})\right\} \text{ with } 0 \le j \le N_1,$$

$$xc_{2i} = E\left\{\sum_m \sum_n a_m a_n * g_1^* (kT_{sa} - nT - \tau) g_2 (kT_{sa} - mT - iT_{sa})\right\} \text{ with } 0 \le i \le N_2$$

between the various delayed replicated signals, where * denotes the complex conjugate operation and $E\{\cdot\}$ the time average operation; and

means for deriving a maximum value of said cross-correlations as i and j vary, namely $M = \max_{i,j}\left(|xc_{1j}|^p, |xc_{2i}|^p\right)$, said maximum value corresponding to the value of the integer multiple.

6. (Previously Presented) An apparatus according to claim 5, further comprising switching means for selecting a proper delayed replica to be sent to said equalizer means as a function of information related to the maximum of the cross-correlations calculated.

7. (Previously Presented) A computer program comprising computer program code means adapted to perform the method claimed in claim 1 when said program is run on a computer.

8. (Previously Presented) A computer-readable medium having a program recorded thereon, said computer-readable medium comprising computer program code means adapted to perform the method claimed in claim 1 when said program is run on a computer.

9. (Currently Amended) An apparatus for compensating a delay between two or more radio transmission lines in space diversity radio transmissions, said apparatus comprising:

a first receiver that receives a first analog signal;

a second receiver that receives at least one second analog signal;

a sampling circuit that samples the first analog signal and the at least one second analog signal to obtain a first digital signal and at least one second digital signal, respectively, a delay being possibly present between the first digital signal and the at least one second digital signal;

equalizers that receive said digital signals at their respective inputs;

a digital delay circuit that digitally delays ~~either~~one of said first and second digital ~~signal or said at least one second digital signal~~signals relative to the other by a period equal to an

integer multiple of the sampling period, said delaying comprising automatically calculating a value of said integer multiple, and

a restoring equalizer that restores the difference between an imposed delay and the real delay.

10. (Previously Presented) An apparatus according to claim 9, wherein said digital delay circuit comprises a calculation circuit for calculating the value of the integer multiple, wherein said calculation circuit:

a delay circuit that realizes delayed replicas $r_{1j}(kT_{sa}) = s_1(kT_{sa} - jT_{sa})$ and $r_{2i}(kT_{sa}) = s_2(kT_{sa} - iT_{sa})$ of said first and said at least one second digital signals, with $0 \le j \le N_1$ and $0 \le i \le N_2$, $N_1 T_{sa}$ being the maximum assumable delay of the first signal with respect to the at least one second signal and $N_2 T_{sa}$ being the maximum assumable delay of the at least one second signal with respect to the first signal;

a correlation circuit that calculates cross-correlations

$$xc_{1j} = E\left\{\sum_m \sum_n a_n a_m * g_2 * (kT_{sa} - mT) g_1 (kT_{sa} - nT - \tau - jT_{sa})\right\} \text{ with } 0 \le j \le N_1,$$

$$xc_{2i} = E\left\{\sum_m \sum_n a_m a_n * g_1^* (kT_{sa} - nT - \tau) g_2 (kT_{sa} - mT - iT_{sa})\right\} \text{ with } 0 \le i \le N_2$$

between the various delayed replicated signals, where * denotes the complex conjugate operation and $E\{\}$ the time average operation; and

a maximum value circuit derives a maximum value of said cross-correlations as i and j vary, namely $M = \max_{i,j}\left(|xc_{1,j}|^p, |xc_{2,i}|^p\right)$, said maximum value corresponding to the value of the integer multiple.

11. (Previously Presented) An apparatus according to claim 10, further comprising a switch for selecting a proper delayed replica to be sent to said restoring equalizer as a function of information related to the maximum of the cross-correlations calculated.

REMARKS

Claims 1-11 remain in the application, the claims having been amended to more clearly define the invention. Reconsideration of the application and allowance of all claims are respectfully requested in view of the following remarks.

The invention defined in the claims without the above amendments is believed to patentably distinguish over the applied art for the reasons set forth in detail in the Request For Reconsideration filed this same date. The above amendments are made to further emphasize the distinctive nature of the invention, by incorporating into claim 1 a portion of the subject matter of allowable claim 2, i.e., that the delaying step involves the calculation of the appropriate delay. This concept I neither shown nor suggested in the applied art.

Entry of the amendment is respectfully requested in that it simply clarifies the distinctive feature of the invention pointed out in the remarks of the response to the previous Office action, i.e., that the delay is variable, as it must be in order to compensate for a delay amount which is unknown from the outset.

Further examination and allowance are respectfully requested.

Respectfully submitted,

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Date: February 1, 2007

Electronic Acknowledgement Receipt

EFS ID:	1485552
Application Number:	09833666
International Application Number:	
Confirmation Number:	1733
Title of Invention:	Method and apparatus for automatic delay compensation in space diversity radio transmissions
First Named Inventor/Applicant Name:	Massimo Brioschi
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Filer:	David J. Cushing
Filer Authorized By:	
Attorney Docket Number:	Q64029
Receipt Date:	01-FEB-2007
Filing Date:	13-APR-2001
Time Stamp:	23:28:47
Application Type:	Utility

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1		Q64029Amendment3.pdf	99230	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Supplemental Response or Supplemental Amendment	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	9

Warnings:	
Information:	
Total Files Size (in bytes):	99230

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